NOVA SCOTIA ELECTRICITY MARKETPLACE GOVERNANCE COMMITTEE

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ALTERNATIVE ENERGY AND ENVIRONMENTAL CONCERNS

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Contents

1 Introduction 1

1.1 Environmental Objectives and the Energy Strategy 1

1.2 Environmental Issues and the EMGC Terms of Reference 2

1.3 Contents of the Issues Paper 3

2 Environmental Actions 4

2.1 Government Actions on the Environment 4

2.2 EMGC Responsibilities 4

3 Definition of Renewable Energy 6

3.1 EcoLogo 6

3.2 Green-e 8

3.3 Ontario 9

3.4 Choices for Nova Scotia 10

4 Renewable Energy Policies 11

4.1 Financing Development of Renewable Resources 11

4.2 Retail Sales of Green Power 11

4.2.1 Retail Access for Green Power 12

4.2.2 Green Power Rate Structures 13

4.3 Renewable Portfolio Standard 14

4.3.1 Issues in RPS Implementation 15

4.3.2 RPS Experience in U.S. Jurisdictions 19

4.4 Government Green Power Procurement and Energy Efficiency 21

4.5 Net Metering 21

4.6 Information Programs 23
5 Emissions Reduction Initiatives 25
5.1 Air Emissions Reductions 25
5.1.1 Sulphur Dioxide (SO_2) 25
5.1.2 Nitrogen Oxides (NO_x) 25
5.1.3 Mercury (Hg) 26
5.1.4 Particulate Matter (PM) 26
6 Energy Efficiency 27
6.1 System Benefits Charge 27
6.1.1 Experience in Other Jurisdictions 29
6.2 Energy Efficiency of Government Facilities 32
6.3 Promoting Use of Energy Service Companies 32
6.4 Public Information Campaigns 33
Appendix: Summary of Net Metering Programs 1

1 INTRODUCTION

1.1 Environmental Objectives and the *Energy Strategy*

The *Energy Strategy*[1] had a strong focus on environmental issues. The more detailed discussions in Volume 2 included separate Parts on Electricity, Renewables, Environment, and Energy Efficiency. Each of these contained Strategy Objectives and actions to achieve the objectives. For electricity, four of the five Strategy Objectives related environmental issues:

- To maintain continued access to secure, reliable and affordable electricity produced in an environmentally responsible manner.
- To create the regulatory and business environment that will encourage independent producers of wind energy and other renewable resources.
- To develop the policy framework that will encourage cogeneration opportunities, and to introduce competition for the construction of new generation capacity.
- To reduce the environmental impacts of electricity production, and to increase efficiency and demand management.[2]

Strategy Objectives in other parts of the *Energy Strategy* included encouraging renewable-based electricity generation capacity, reducing the emissions of specific pollutants associated with electricity generation from fossil-based fuels, and providing mechanisms to encourage conservation and more efficient use of energy.

With respect to electricity generation, environmental policy is being implemented in a context of change in the structure of the market. Identification and evaluation of policies to improve environmental protection and enhancement in the electric industry is both facilitated and complicated by restructuring. Electricity market restructuring brings new rules, organizations, and strategies. The decisions made by the profit-maximizing owners of individual generating units are likely to be quite different from the system-wide cost-minimizing decisions made in the past by vertically integrated monopoly utility owners. Open access markets create an opportunity to synchronize the evolving energy framework with current environmental goals and objectives. The electric market structure can create markets, as well as incentives and guidelines to operate in an environmentally sustainable manner.

[1] Government of Nova Scotia, *Seizing the Opportunity: Nova Scotia's Energy Strategy*, Dec., 2001. Referenced as *Energy Strategy*.

[2] Energy Strategy, Volume 2, Part III, pg.4.

At the same time, electricity restructuring can reduce the incentives that integrated utilities once had to improve their environmental performance. This is especially true where the integrated utilities were government owned; in such cases, the government could set environmental policy, at least as practiced by the utility, by policy direction to the utility rather than by explicit environmental policy. In Nova Scotia, the Energy Strategy states that NSPI, over the near term, will remain a vertically integrated cost-of-service utility with an obligation to serve, and therefore, the market is expected to be restricted, at least at first. Even so, the time of restructuring is one where environmental initiatives could be pursued.

For Nova Scotia, the amount of electricity restructuring may be relatively modest. Even so, the time of restructuring presents an opportunity to institute new policies affecting the environmental performance of the electricity industry. Perhaps more importantly, the formation of the EMGC allows input of the multi-stakeholder committee to the implementation of the actions required to achieve the Strategy Objectives stated in the *Energy Strategy*.

4.1 Environmental Issues and the EMGC Terms of Reference

Drawing on the *Energy Strategy*, the Terms of Reference for the EMGC contained several tasks relating to environmental issues. These included

- Define "renewable" energy for public policy purposes.
- Provide recommendations for the promotion of co-generation.
- Determine if green power marketers should gain access to end-use customers through physical or financial contracts.
- Define the appropriate role of NSPI relative to green power in the medium and longer term.
- Recommend methods of monitoring green power sellers to ensure that all financial transactions are appropriate.
- Define the target capacity, time frame and market participants appropriate to implement a mandatory Renewable Portfolio Standard.
- Define the circumstances when net metering would be permitted or encouraged.

The Energy Strategy also said that the EMGC would define the maximum size of generation to be eligible for net metering.

1.1 Contents of the Issues Paper

This Issues Paper will address all of the above issues except for encouragement of cogeneration, which will be the subject of a future Issues Paper. The paper also addresses some issues which were not assigned to the EMGC in its Terms of Reference or in the Energy Strategy, but which the EMGC might wish to comment or make recommendations on. In addition, the Issues Paper notes some of the environmental initiatives from the Energy Strategy which will impact on the electricity industry, but which the EMGC was not asked to comment on.

The next section deals with issues related to the definition of renewables for policy purposes and to issues of monitoring and information with respect to renewables. The following section takes up specific policies to promote renewables and small-scale generation, including net metering programs. The Issues Paper then discusses energy efficiency initiatives, including the proposal for a Systems Benefit Charge.

The last section of the Issues Paper deals with initiatives to reduce emissions of air pollutants associated with electricity generation.

In this Issues Paper, passages in italics are direct quotes from the *Energy Strategy*, with the section numbers for the source shown in parentheses after the quotation.

2 ENVIRONMENTAL ACTIONS

2.1 Government Actions on the Environment

Government policies affecting industries, such as electricity generation, are intended to alter the outcome that would otherwise occur. With respect to environmental performance of electricity generation, there are several areas of government intervention, all of which relate to overall Strategy Objectives including improving the province's environment and enhancing the quality of life.

One such area is in the use of renewable resources to generate electricity. Some renewable resources, such as hydroelectric generation, are already economic. Most such resources have already been developed. Other resources, like wind generation, are not economic now in the sense that they have higher costs than conventional generation. But in the case of many of these technologies, costs are falling to make them increasingly close to the cost of conventional generation. In addition, renewable resources have much lower environmental impact. Adding the cost of the environmental degradation to the money cost of conventional generation might well bring its cost above that of renewables. Governments therefore often do, as the *Energy Strategy* does, commit to financial support for development of electricity generation from renewable resources.

Similarly, in the absence of government policies, individual companies have no incentives to reduce their emissions of harmful pollutants. To maximize profits, they minimize costs; reducing emissions usually raises costs. Governments set emissions standards to express the public interest in clean air, and make clear that the private profit interest does not allow the company to use the air as a free disposal site for its waste.

Government interventions take essentially two forms: they can dictate actions (like using specific emissions control technologies), or they can influence the market conditions (and let market participants determine the exact outcomes). There are also intermediate positions, like dictating outcomes (emissions limits, for example) and letting the market participants determine how to achieve the outcomes.

2.2 EMGC Responsibilities

The EMGC has two basic modes of action with respect to environmental issues:

- Ensure that the market model it adopts is consistent with environmental goals, particularly with respect to renewables. The EMGC has done this by including

environmental impacts as one of the criteria used to evaluate its recommendations.

- Explore ways it can actively encourage the adoption of renewable and lower impact technologies, following the directions to it in the *Energy Strategy* and in its own Terms of Reference.

5 DEFINITION OF RENEWABLE ENERGY

Many of the policies discussed in this Issues Paper depend on an acceptable definition of renewable energy (or "green power"). Renewable sources such as solar, wind power, earth energy, biomass, and small hydraulic power facilities can be widely recognized, but policy implementation requires more precision. Implementing commitments such as those in the Energy Strategy will mean committing financial support to some generators and not others. Defining precisely which generation will be eligible for support is required to implement any such policy.

Many jurisdictions have policies giving some preference to specific forms of electricity generation. Each of these has adopted some definition to suit its own purposes. The definitions often extend to a certification and verification process, intended to ensure that the renewable generation does meet the criteria and that at least as much power from renewable resources is being generated as is being paid for.

For Nova Scotia, the two basic choices with respect to defining renewable resources are to accept a definition developed elsewhere or to develop one specifically for the province. A similar choice is available with respect to certification, verification and monitoring procedures.

Two definition, certification and verification programs are coming into widespread use in North America, one in Canada and one in the United States. Nova Scotia could adopt one of these programs.

5.1 EcoLogo

The Canadian definition that is gaining widespread acceptance is the EcoLogo certification. EcoLogo is the registered trademark of Environment Canada's Environmental Choice Program (ECP). NSPI has committed to the EcoLogo certification for all green power it sells.

Terrachoice, a private company, administers EcoLogo and audits and certifies the products that apply. Note that the EcoLogo definition is not limited to a single product. Producers can apply for definition and certification of a variety of products. EcoLogo can then be applied to all products meeting the criteria.

To get EcoLogo certification, a product application triggers a series of evaluations to determine if the product warrants EcoLogo certification. Then

The Environmental Choice Program has made a commitment to promote

electrical energy sources with reduced environmental impacts. The ECP recognizes electricity that has been generated from naturally occurring energy sources (such as the wind and the sun), and from power sources that, with the proper controls, add little in the way of environmental burdens (such as less intrusive hydro and certain biomass combustion).

Certification criteria include:

- The facility must be operating, reliable, non-temporary and practical.
- Appropriate consultation with communities and stakeholders is required during project planning and development, and prior or conflicting land use, biodiversity losses and scenic, recreational and cultural values must have been addressed.
- No adverse impacts for any species recognized as endangered or threatened.
- Supplementary non-renewable fuels must not be used in more than 2% of the fuel heat input required for generation.
- Sales levels of ECP-certified electricity must not exceed production/ supply levels.

Specific energy sources include:

- Solar (cadmium containing wastes must be properly disposed of or recycled)
- Wind (protection of concentrations of birds including endangered bird species)
- Water (compliance with regulatory licenses; protection of indigenous species and habitat; requirements for head pond water levels, water flows, water quality and water temperature; and measures to minimize fish mortality and to ensure fish migration patterns)
- Biomass (use only wood wastes, agricultural wastes and/or dedicated energy crops; requirements for rates of harvest and environmental management systems/practices, and limits on emissions of air pollutants)
- Biogas (maximum levels for emissions of air pollutants; and leachate

management)

- Other technologies that use media such as hydrogen or compressed air to control, store and/or convert renewable energy

- Geothermal technologies

Environment Canada is in the process of developing a guideline to define a "low-impact renewable electricity" product to qualify for the EcoLogo label.[3]

7.1 Green-e

Green-e is a voluntary certification and verification program for green power products developed by the Center for Resource Solutions, a non-profit U.S. organization based in San Francisco, California. The Green-e standard is determined by a board, based on input received from regional advisory committees.

When the Green-e logo is displayed next to an electricity product, the product must meet the following requirements:

- 50% or more of the electricity supply comes from one or more of these eligible renewable resources: solar electric, wind, geothermal, wind, biomass, and small and certified low-impact hydro facilities,

- if a portion of the electricity is non-renewable, the air emissions are equal to or lower than those produced by conventional electricity,

- there are no specific purchases of nuclear power, and

- the product meets the Green-e new renewable requirement.[4]

Electricity providers selling Green-e certified electricity are required to abide by the Green-e Code of Conduct, which governs participation in the Green-e Program. The Code specifies levels of public information and an annual audit process.

The Green-e verification process consists of the semiannual Compliance Review and the annual Process Audit. These audits check that the green power seller has bought enough qualifying resources to meet its demand. The

[3] Draft is available at http://www.environmentalchoice.com/default_grc.cfm?Content=Login.

[4] The Green-e program's new renewable requirement defines new renewables as energy from renewable facilities that have come online since 1997, and in New England since 1998.

process also tracks television and other advertising to ensure that the developer is not making false statements.

4.1 Ontario

Ontario does not have (or need, since it does not have either an RPS or a green pricing program) an official definition of renewables. It does have a definition on what generation is eligible for the set aside for small generators under the Ontario Emissions Trading Code. In Ontario, for a renewable energy project to be eligible for an award of NO or SO2 emission allowances under the Regulation a project must:

- Be the result of construction that began after January 24, 2000.
- Be located in the province of Ontario.
- Produce electricity which is delivered into the IMO-controlled grid using one or more of the following methods:
  - photo-voltaics
  - wind turbines
  - run of river hydro-electric
  - new hydro-electric power from existing dams (projects which produce no increase in reservoir size).

The Ontario Select Committee on Alternative Fuel Sources expanded the definition of renewable power used in the Code to include new power generated from the use of biomass, such as methane from landfill and/or anaerobic composting, use of agricultural or wood wastes, and stacked fuel cells connected to the powergrid.[5]

4.1 Choices for Nova Scotia

The current EcoLogo definitions were derived after several rounds of discussions with stakeholders. Similarly, in the United States, the development of the green-e definition required a significant commitment from stakeholders.

There are several advantages to adopting a standard definition, particularly EcoLogo. The most important is that it exists and has some credibility as a result of stakeholder consultations during its development. It is sponsored by

[5] Ontario Select Committee on Alternative Fuel Sources, *Final Report,* Section A7, Recommendation 28, p. 19, at http://www.ontla.on.ca/Committees/reports.htm.

a federal government deparment, and is increasingly becoming the standard for Canada.

Its most important drawback is that it cannot recognize the specific characteristics of the Nova Scotia electricity industry. Because of its generality, the EcoLogo process is not universally acceptable. Specific groups may have requests to alter the definition to include their technologies. Often, both sides of this debate have good arguments.

For example, in Alberta, small generators (30 kW) are being placed next to producing oil wells located in remote, off-grid, areas. These generators use the gas from the wells, much of which was previously flared, to produce electricity. The electricity is used on site to power the wells, displacing diesel oil or other fuel that had to be trucked in. By most definitions, this generation is not renewable, since it uses a fossil fuel. But its overall environmental impacts are quite positive.

Information on the EcoLogo definition is available from www.environmentalchoice.com. Information on green-e is available from www.green-e.org.

5 RENEWABLE ENERGY POLICIES

5.1 Financing Development of Renewable Resources

Given that the electricity they produce is more expensive than conventional energy, there are several possible sources of finance for renewable energy development:

- Voluntary consumer programs, under which consumers sign up to pay a premium for electricity from renewable resources;
- Utility programs, where a monopoly utility buys energy from renewable resources and, by putting the cost in its rate base, spreads the cost across all its customers;
- Renewable portfolio standards, which require that a certain fraction of all energy come from renewables, forcing retailers (or whatever market participant has the requirement) to spend more for electricity from renewable resources;
- Direct subsidies to renewables, under which government pays renewable producers directly a subsidy (or allows tax credits) to make up the difference between the cost of conventional and renewable resources; and
- Emission reduction credits, which give renewable resources payments for the pollutants they do not emit.

In Nova Scotia, the Energy Strategy discussed four of these five possible sources of funding. The EMGC is expected to make recommendations with respect to the implementation of the first three. They are discussed in order in the following sections.

5.1 Retail Sales of Green Power

The Energy Strategy mentions two forms of voluntary retail sales of green power. The first relates to retail access for independent power producers (IPPs) with renewable resources. The second relates to a green pricing program to be offered directly by NSPI. These are discussed in turn in this section.

5.1.1 Retail Access for Green Power

Allow Nova Scotia-based independent power producers (IPP) to have open access to NSPI's transmission system, and if the IPP chooses, to market green power directly to retail customers. (2.3.4)

The EMGC's TOR assigns it the responsibility for determining whether green power producers should have physical or financial access to consumers.

Financial contracts for retail purchases of green power typically include an agreement between the seller and the voluntary buyer for a fixed amount of green power or a fixed premium. For example, if the green power premium is determined to be $.015 per kWh., and it is sold in blocks of 1000 kWh. per month, then the buyer would agree to pay an additional $15 per month to the green power provider. The premium could be billed through a distribution utility, or it could be paid directly from the consumer to the green power supplier.

Experience with such programs shows that consumers are more likely to sign up for the green power if the project their premium supports is new and visible. Customers who can see that there actually is green power being generated with their money are more willing to finance the project.

A physical bilateral contract for the sale of electricity requires that the buyer and seller match their schedules. The generator schedules with the system operator to inject a certain amount of electricity into the system at a specific injection point, and the buyer agrees to withdraw the same amount at a specified withdrawal point at the same time. These are called balanced schedules. Bilateral contract markets impose financial penalties for imbalances created when either the seller or the buyer fails to perform as scheduled.

Physical contracts for the sale of green power would imply therefore that the customer can predict its consumption and that the generator can predict its generation. But the essence of some of renewable technologies is that they are intermittent and, at least to some extent, unpredictable. This is especially true of wind and solar power, which vary with the weather.

The EMGC will determine whether to recommend financial or physical contracts for retail green power sales in Nova Scotia.

5.1.2 Green Power Rate Structures

Establish (through the UARB and NSPI) a green-power purchase rate structure for all NSPI rate classes. This rate will apply to sales by NSPI but not necessarily for IPP sales direct to customers. (2.3.4)

The EMGC's TOR assigns it responsibility for recommendations with respect to NSPI's role in green power in the medium and longer term.

In the near term, NSPI has already undertaken a green pricing program, and its rates have been approved by the UARB. This program is in support of the 50 MW of renewable generation contracted by NSPI after issuing an RFP.

Green pricing programs are popular with utilities. They are similar to the voluntary premium pricing programs discussed in the last section. Like those programs, they let consumers buy at a premium price electricity from renewable resources. The premium charged to green power customers covers the cost to the distributor for purchasing green power. The average reported green premium relative to annual electricity expenditures is 8.4%, although this varies depending on the region.[6]

The reported premium cost/kWh ranged from 0.4cents/kWh to 5.0 cents/kWh (US dollars). Whether green pricing is in the form of energy tariffs, capacity tariffs, or other mechanism, the design and marketing of the green power product is a critical element.[7]

The success factors are similar to those for premium pricing programs directly from IPPs. Other success factors include the personal value created by the green pricing program and the extent to which a utility partners with the community to publicize the program.
A utility-based green pricing program could attract business customers. A recent NREL study[8]

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Ed Holt, Ryan Wiser and Rudd Mayer for National Wind Coordinating Committee, *Understanding Non-Residential Demand for Green Power,* January 2001 Consensus Report.

7

Blair Swezey, Lori Bird, National Renewable Energy Laboratory (NREL), Green Pricing Study, September 2001.

8

Ibid.

found that approximately 25 percent of the total power sold through green power programs is to non-residential customers.
Given that a utility-based green pricing program already exists in Nova Scotia, the EMGC will consider its future. The Energy Strategy dictated direct sales of green power to all customers in Nova Scotia. With that, there will be two premium pricing green power programs, one for IPPs and one run by NSPI. The EMGC will consider whether this situation should continue over the medium term or whether one of these programs should be terminated, or perhaps merged with the other.

5.2 Renewable Portfolio Standard

Create a short-term voluntary renewable energy target for new IPPs totalling 2.5% of NSPI's generation capacity, or approximately 50 MW. The government and NSPI will monitor the voluntary process for three years and then establish a longer-term renewable portfolio standard (RPS) target. (2.3.4)

The EMGC is assigned the tasks of defining renewables for public policy purposes and of defining the target capacity, time frame and market participants for a renewables portfolio standard.

A Renewable Portfolio Standard (RPS) requires that a certain percentage of annual electric consumption come from renewable energy.[9] Generally, an RPS imposes a minimum renewables purchase requirement (typically as a percentage of energy sales) imposed on either retail providers or generators.

An RPS framework is designed to promote efficiency within the renewables market. Under RPS, certified renewable projects are required to compete amongst themselves to supply certificates. Unlike a one-time competition for funds, each project must continually compete to keep its place in the market created by the RPS. This competitive environment encourages renewable generators to act efficiently, resulting in prices that reflect the long run incremental cost of the renewable power relative to conventional generation. A shortage of certified power would raise its relative price, encouraging the development of additional certifiable supply.

Other benefits associated with RPS include relatively low administrative burden, increased certainty and stability when parties enter into long -term contracts, and support for rational behaviour. The certainty of the renewables market created by a properly designed RPS will facilitate the negotiation of long-term contracts and financing arrangements for the renewable power industry. This increased certainty will result in lower financing costs and

[9] Discussion of RPS is based on information from the American Wind Energy Association (AWEA), *The Renewables Portfolio Standard: How It Works and Why It's Needed* (October 1997), at http://www.awea.org/policy/rpsbrief.html.

ultimately lower renewable power costs.

Due to the emphasis on generating renewable power at the least cost, RPS promotes cost effective development of renewables. This may result in a non-diversified portfolio of renewable projects comprised primarily of projects employing proven renewable low cost technologies. This bias towards low cost renewable technologies may be partially alleviated through the implementation of other policies that provide additional financial incentives to more innovative technologies and practices or specifying the technologies that are certifiable.

5.2.1 Issues in RPS Implementation

Several major issues must be resolved in the implementation of an RPS:

- The definition of renewables eligible for credit under the RPS;
- Verification and monitoring of the generation of the electricity from renewable resources;
- How the market participants can meet the RPS, whether only by direct purchase of green power or through a system of trading credits or other attributes of the power;
- Identification of the market participants who will be responsible for meeting the RPS;
- The base level to be set for the RPS (that is, the base amount of renewables as a % of the total); and
- The rate of escalation of the RPS.

For the EMGC to meet its terms of reference with respect to an RPS, it must address all of the above issues.

The issues of definition and verification were addressed in Section 3 of this Issues Paper. These could have applications beyond their use in the RPS.

Most RPS programs do not require each responsible market participant to own or contract directly with a specific renewable energy resource. Instead, they create some credits or other instrument representing generation from renewables, and the credits can then be freely traded. The responsible market participant therefore presents credits to equal its required total, not necessarily proof of direct ownership or contracts. A system of credits of course requires verification of the credits themselves, monitoring to ensure that the electricity is actually generated and that the resulting credits are sold only

once. These are the responsibility of the monitoring agency.

With a system of tradeable credits for generation from renewable resources, providers can meet the RPS requirements in a number of ways:

- Invest in renewable projects
- Generate their own credits
- Enter into contracts to purchase renewable energy
- Enter into contracts to purchase credits
- Purchase credits in the spot market,
- Or any combination of the above

Additional alternatives available under this framework include the ability to choose the source of renewable energy, provider of renewable energy/credits, and contract terms and conditions.

The advantages of credits are that they create a market-oriented instrument helping to ensure efficiency in the renewables generation and makes meeting the RPS requirement much easier for participants. Their main disadvantage is that consumers have much more difficulty understanding credit systems and therefore more difficulty accepting that the premiums they are paying through their electricity bills are actually going to promote green power.

As part of the implementation mechanism, the EMGC will address the issue of whether the RPS in Nova Scotia will allow credits or will require direct contracting.

Which market participants are required to meet the portfolio standard depends on the circumstances of individual jurisdictions. The main alternatives are to require that all generators offer a fraction of their total supply from renewable resources, or that retailers (or load serving entities –LSEs – do so). The choice can depend on which market participants are seen as better able to manage the purchase of the green power (or credits).

In restructured electricity markets with competitive wholesale pools, the RPS requirement is usually placed on the LSEs. They are responsible for buying and supplying electricity to their customers. Generators only provide energy to the market, which is intended to be priced at marginal generation cost. If they were to be required to offer green power, it might require a separate market for green power credits, because it would be difficult to price the green power in the competitive wholesale pool market.

On the other hand, a vertically integrated utility providing both generation and default supply could logically assume the RPS requirement.

The base level for the RPS is usually chosen with some regard for how much existing generation in the jurisdiction qualifies as renewable under the definition adopted. The choices of strategy are to make the initial target easily attainable or to make it a difficult stretch. At one extreme is the target set in Maine, described below, which is below the current level of renewables. At the other extreme would be a target that required large immediate investment in renewables.

The table below was provided by NSPI and shows the installed capacity of renewables currently in the province. This table does not include the 50 MW of wind capacity expected to result from the recent RFP process initiated by NSPI.

Statistics Canada data indicate that about 22% of Nova Scotia's generation capacity in 1999 was from renewable resources. Of that, almost half was in hydroelectric facilities with capacity greater than 15 MW. Excluding the large hydroelectric generation, therefore, reduces the fraction of existing renewable resources to about 10 %. The share of renewables production is probably lower than its share of capacity, since all of the resources except biomass can be expected to have relative low capacity factors.

Existing Renewable Generation Capacity in Nova Scotia (KW)						
	Hydro	Tidal	Wind	Biomass	Solar	TOTAL
NSPI	361900	19500	1260	0	0	382660
IPPs	730	0	0	24840	0	25570
Self Generation	5520	0	70	52200	2	57792
TOTAL In-Province (KW)	368150	19500	1330	77040	2	466022

The level of the initial requirement chosen will clearly depend, therefore, on the definition of renewables. If large hydroelectric generation is included, the target could be quite high, up to about 20% (depending on capacity factors) of the total energy in the province. If large hydro is not included, the target would be somewhat lower.

The purpose of an RPS is to promote the development of new generation from renewables. The usual method to promote new development is to escalate the RPS over time. The rate of escalation is a policy decision, but its parameters can be defined.

A rate of escalation of an RPS that is greater than the expected rate of growth of demand implies that new renewable generation will displace some of the existing generation (or that the existing generation can be exported, which would mean that it will still be in service and having its impact on the environment.) Often, the rate of escalation is chosen to be some fraction of the expected growth rate. That fraction is then, effectively, the fraction of electricity growth which the RPS requires be met by new generation from renewables.

According to the *Energy Strategy*, peak electricity demand in Nova Scotia is expected to grow by an average rate of about 0.8% per year over the next 20 years, or about 350 MW.[10] To require half of the electricity demand growth to be met by renewables, therefore, would mean that the RPS fraction would grow by about 0.4% per year.

The *Energy Strategy* stated that a mandatory RPS would be considered after three years. The structure described above would be appropriate for such a mandatory program.

6.0.1 RPS Experience in U.S. Jurisdictions

The case studies below show how some jurisdictions in the United States have implemented RPS programs. One point that is clear from these case studies is that the states took their potential resources into account in setting up their RPS programs. An obvious example is that Arizona, with little water and lots of sun, has focused on solar power.

In the United States, RPS is in effect in nine states and Washington DC. While the general framework is the same, the specific details vary reflecting the different policy objectives, renewable resource endowments, and the existing level of renewables infrastructure in each jurisdiction. Generally the percentage of electricity sales derived from renewable sources begins at an initial level equal to or close to the current level of renewables, and increases over time.[11] Typically, the average requirement in the US is currently about 5% but will escalate over time.

[10] *Energy Strategy*, Volume 2, Part III, pg. 6.

[11] For more information about states with RPS, see http://www.dsireusa.org/.

Arizona

Arizona has chosen to focus its efforts towards renewable generation in lieu of energy efficiency initiatives. In March 2001, Arizona implemented an Environmental Portfolio Standard (EPS) requiring a minimum of 0.2% of retail energy sources to be derived from renewable sources and increasing annually until it plateaus at 1.1% in 2007. The EPS strongly favours solar generation, as a minimum of 50% of EPS must be satisfied through solar generation, gradually increasing to 60% in 2004. To fund the EPS, utilities were required to transfer their DSM and renewables funding proposed under their restructuring plans to their respective EPS budgets. This funding will be further supplemented by an EPS surcharge to be added to customers' bills. The monthly charge is capped at $0.35/residential customer, $13/commercial customer, and $39/month for industrial users. In aggregate, the annual EPS budget will be approximately $24 million for all utilities.

There is a concern that during the initial period, funding could be insufficient to meet their EPS requirements, which may result in increases in rates to cover the deferred costs. The Commission will establish a Working Group to review the costs and benefits associated with the EPS. The results of the study will determine whether the EPS will continue to escalate as scheduled or remain frozen until a future period.

Utilities can earn extra credit multipliers through activities promoting Arizona development, such as purchasing locally produced equipment or constructing the plant in Arizona.

The Commission has also imposed a penalty system to commence as early as 2004. Utilities not meeting their EPS requirement will be subject to a 30¢/kWh penalty for every kWh short. The proceeds of the penalty will be used to purchase solar generators or solar electricity for use by the state's public entities including schools, cities, counties and state agencies.

Maine

Maine has the highest standard in the United States, requiring 30% of supply from renewable resources. This indicates how deceptive a simple comparison of the base percentage can be, because the Maine program is not considered likely to promote large development of renewables.

In Maine, the definition of renewable resources is quite broad and includes cogeneration projects, relatively large hydroelectric projects, municipal solid waste, and other resources that are generally viewed as renewable. Some observers have suggested that the broad definition was used to cover the vast majority of the QF-based power that was developed in Maine in response to

PURPA. This high standard has not resulted in a meaningful increase in renewables. This is in part because of the broad definition, the fact that the existing state resource mix already satisfied the target, and the fact that Maine was the only jurisdiction that initially pursued an RPS in the six state New England region. Therefore, generation that satisfied Maine's definition tended to flow to Maine (at least contractually), allowing parties to achieve the standard with no meaningful change in behavior. There are two primary lessons from Maine: (1) pay attention to what qualifies as a "renewable" or "alternative" resource; and (2) recognize the implications of policies pursued by adjacent jurisdictions and trading partners.

Massachusetts

The Massachusetts Division of Energy Resources (DOER) recently released draft regulations for implementing the state's renewable energy portfolio standard. As part of the state's electricity restructuring law, suppliers must provide 1% of their electricity from new renewables beginning in 2003, rising by 0.5% each year to 4% in 2009.

6.1 Government Green Power Procurement and Energy Efficiency

Participate in a green energy program, at premium pricing, for a percentage of the electricity used in provincial public buildings. (2.4.4)

Encourage municipalities and public sector agencies to set their own green power purchase targets for the voluntary period. (2.4.4)

There are many benefits associated with the province procuring alternative fuels and implementing energy efficiency measures for their own use. As a large energy consumer, the province's increased demand for energy from renewable sources could hasten the commercialization process so that manufacturers realize economies of scale sooner. This results in lower prices which can be passed on to the private sector.

The province's diversity in demand due to its wide range of locations and facility types provides for the opportunity to implement a wider range of technologies and energy efficiency practices. This supports the development and commercialization of a more diverse mix of technologies, and energy efficiency measures.

With its own environmentally sound policies, the province would serve as a role model for the private sector.

To further increase the likelihood that these technologies will be better

accepted in the private sector, the province should emulate private procurement practices while recognizing that alternative energies is still an emerging industry. This creates additional transparency for the private market which serves to reduce some of the risk associated with adopting these technologies. The EMGC could choose to support the government in these initiatives.

6.2 Net Metering

Formalize NSPI's current policy of allowing net metering for renewable energy systems. Establish through the UARB a specific category under NSPI's rates and regulations. The maximum capacity for systems to be eligible to participate will be recommended by the EMGC. (2.4.4)

The EMGC's TOR assigns it the responsibility for defining circumstances for net metering.

Net metering applies to small generation facilities within a customer's premises. It allows the electricity meter to run backwards when the embedded generation is producing more than the customer's load. In effect, the utility is buying electricity at its retail rate from its retail customers, and selling electricity back at a different time. The utility loses in this transaction, because it does not make any markup to cover its own costs.

Net metering is important for distributed small-scale renewable energy projects. Because wind and solar are intermittent energy sources, customers may not be using the power as it is generated. Net metering allows these customers to receive the full value of the electricity they produce without the need for expensive battery storage systems. Some claim that it is more than the full value since the supplier/utility is only avoiding the commodity costs, but the customer is able to avoid the entire costs reflecting commodity, transmission, distribution and retail margins. Clearly, net metering improves the economics of these projects. However, limits on the quantity that can be sold back to the market are needed to minimize the potential for market distortions.

Prior to the implementation of net metering, safety concerns and technical issues resulting from interconnection with the local grid must be addressed. A major safety concern is that a distributed generation power source will energize lines while repairs are being performed. While current static inverter technology will automatically disconnect a distributed generation power source in the event of a power outage, a manual disconnect switch is also available. The cost of installing such a switch could affect the economics of a small distributed generation project. Technical issues related to net metering include power quality and interconnection standards.

Issues for the EMGC with regard to net metering include allowable technology and size, allowable customer types, any system-wide limit, and treatment of net excess generation (NEG). The Appendix contains a summary of how U.S. states have approached these issues. The following section discusses the issues briefly.

Net metering imposes costs on the distribution utility. Because it has to pay its full retail price, it cannot recover its own costs. If electricity costs vary over time (in a real time market, or even with time of use pricing), the utility may lose money on net metering. The net metering customer could be injecting when the system price is low and withdrawing when the system price is high. For some kinds of renewables on some kinds of electricity systems, it is likely that distribution utilities will lose money in this way.[12]

For this reason, all net metering programs place some restrictions on eligibility. The most obvious restriction is size; all net metering programs set an upper size limit on generators eligible for net metering.[13] Some programs also restrict net metering to generation from renewable resources.

Another policy issue is the period over which the metering is netted out, and what is done with any surplus of injections over withdrawals, or net energy generation. If the metering is netted out over a month, there is less scope for the customer to move generation across peak and off peak periods than if the period were a year.

Monthly netting also creates a higher risk of net energy generation. In some programs, net energy generated must be bought by the distribution utility at some price, though probably not at full retail. In other jurisdictions, net energy generated simply reverts to the distribution utility at no further cost.

6.3 Information Programs

Implement information programs to promote efficient use of renewable energy technologies. (2.4.4)

A wide range of programs can be implemented to achieve this objective.

Public awareness campaigns play a critical role in providing information about alternative energy programs and energy efficiency initiatives. These programs are often sponsored and administered by utilities, governments, and regulatory agencies. Examples of these programs include media campaigns,

[12] For example, a wind generator is likely not to be running in the hottest, most humid, least windy weather conditions which create the peak demands in the summer period.

[13] Larger embedded generators are still able to sell electricity, either to their host utility or to the market, depending on the market rules.

event sponsorship, and "how-to" manuals.

Targeted awareness campaigns are similar to the general mass-market campaigns described above except they are tailored to a specific segment of the population. The population can be segmented by attributes such as user type, their decision-making process, technology, or geography. Accordingly, each segment has different informational needs. Therefore targeted campaigns tend to be more effective since they are better designed to address a segment's specific needs.

Educational programs such as formal training programs provide the necessary skills to individuals to work with alternative technologies. This is necessary due to the highly technical nature and newness of alternative technologies. Formal instruction can cover areas including installation, operations and maintenance. Upon successful completion of the training, individuals are eligible to be licensed as qualified professionals to work with alternative technologies.

Compared to more traditional generation technologies such as cogeneration and coal facilities, alternative technologies are generally more labour intensive. Therefore, increasing the availability of qualified individuals will ensure that skilled labour is not a barrier to the implementation of alternative technologies in the market.

Formal training programs also provide quality assurances to the customer that these trained individuals have the necessary knowledge to accomplish their tasks effectively.

7 EMISSIONS REDUCTION INITIATIVES

7.1 Air Emissions Reductions

The *Energy Strategy* stated the objective of reducing the emission of air pollutants from the generation and consumption of energy in a manner that is consistent with national standards. This included short-term reduction targets to 2005 as well as longer-term targets beginning in 2006 and beyond. The four pollutants specifically targeted by the *Energy Strategy* are sulphur dioxide (SO_2), nitrogen oxides (NO_x), mercury, and fine particulates.

7.1.1 Sulphur Dioxide (SO_2)

Reduce SO_2 emissions by 25% from current levels by 2005. Further reduce SO_2 in the longer-term to achieve a cumulative reduction goal of 50% by 2010. (2.6.2.4)

Nova Scotia has relatively high per capita SO_2 emissions, most of which come from burning coal for electricity generation. Nova Scotia is party to a number of agreements governing SO_2 emissions. The province has a cap of 189,000 tonnes per year, of which 145,000 tonnes per year are allocated to NSPI. Nova Scotia has made commitments to reduce SO_2 emissions as part of the *Canada-wide Acid Rain Strategy* and the *Acid Rain Action Plan* of the Conference of New England Governors and Eastern Canadian Premiers.

7.1.2 Nitrogen Oxides (NO_x)

Reduce NO_x emissions by 20% below 2000 levels by 2009. Continue to require all utility and industrial boilers to install low-NO_x burner technology during upgrades and natural stock turnover. (2.6.2.4)

Emissions of NO_x are controlled through federal point source targets promulgated in 1981, which apply to new power plants and major renovations at existing plants. Unlike SO2 reductions, which apply at a corporate level and allow a limited trade-off between projects at different facilities belonging to the same owner, NOx standards apply to each facility individually. Starting with a cap of 0.6 lb/MMBtu, the targets called for a reduction to 0.26 lb/MMBtu for plants burning liquid fuels, and 0.4 lb/MMBtu for plants burning solid fuels by 1995. There were recommended targets for 2000 as well. Although never officially adopted, these targets form guidelines that are accepted throughout the industry. The 2000 guidelines are 0.21 lb/MMBtu of NO_x for liquid fuels, and 0.09 lb/MMBtu for gaseous fuels.

In the commitments made by the premiers and governors in 1998, Nova Scotia committed to a 20-30% reduction in NO_x emissions by 2007. In 2000, NO_x emissions were approximately 26 k tons system wide, thus a proportional 30 percent reduction would represent a reduction of 7.8 k tons per year. Requirements to update low-NO_x burners and selective catalytic reduction (SCR) should be sufficient for Nova Scotia to meet NO_x reduction requirements.

7.1.3 Mercury (Hg)

The 1998 Mercury Action Plan of the Conference of New England Governors and Eastern Canadian Premiers established a regional goal of virtually eliminating mercury emissions. Interim targets are a 20-50% reduction by 2005 from coal-fired utility boilers, and a 60-90% reduction by 2010. With the highest emissions attributed to coal-fired facilities, NSPI will be required to use imported coal with lower mercury content, and to use technological control measures.

7.1.4 Particulate Matter (PM)

Comply with Canada-wide Standards for Particulate Matter and Ozone by 2010. (2.6.2.4)

Canada-wide standards for particulate matter and ozone ratified in June 2000 will require a wide range of emission reduction initiatives that will also result in significant reductions in SO_2 and NO_x.

8 ENERGY EFFICIENCY

Increasing energy efficiency is one of the most beneficial ways to reduce the demand for fossil fuels. It substitutes a zero impact activity for a high-impact one. True energy efficiency initiatives provide consumers with the same end use energy services while using less energy.

The *Energy Strategy* energy efficiency objectives include encouraging conservation and efficient use of the province's energy resources and increasing public awareness of the importance and benefits of conservation and efficient energy use. The *Energy Strategy* also identified a number of action items to achieve the objectives. These are grouped together and discussed below.

8.1 System Benefits Charge

Government will encourage NSPI and UARB to develop creative DSM and SBC programs to improve electricity efficiency and reduce overall consumption. (2.3.19)

Systems Benefit Charge (SBC) programs have been developed to ensure continued support for renewable energy and energy efficiency programs after electric-sector restructuring. They can also be used to fund other social programs, such as cross-subsidies for low-income consumers, whose costs had formerly been bundled into utility rates. To maintain funding for these programs, some jurisdictions implemented a non-bypassable wires surcharge known as a System Benefits Charge.

Generally these programs are managed by a regulated utility. A new trend is to centralize the administration and delivery of these programs in a not-for-profit organization. Vermont recently adopted this model, Wisconsin is in the midst of transitioning towards a centralized model and such a proposal is currently being reviewed in New Jersey.

System benefit charges (SBCs) are relatively easy to implement and provide transparency to customers about the size and use of the fund. However the administration of the funds raises issues including responsibility for fund management and for program selection.

There are three primary ways to administer the collected funds:

(1) Through an existing independent entity such as a government agency. However, such an existing agency would likely have to develop capability in the areas to be promoted;

(2) A special purpose entity could be created specifically to administer these funds. This will result in increased administrative overhead, but is more likely to result in an organization that is well suited to its task;

(3) The local distribution utility that is responsible for collecting the funds could be responsible for overseeing the programs. Here as well, it is not clear that the LDC will possess the necessary skills to administer these programs effectively or efficiently.

Alternatives also include establishing a centralized agency but allowing individual utilities to undertake their own programs if they choose.

Based on the experience in Vermont, the creation of a centralized body can require a multiple-year effort to staff the organization and begin delivering programs. However as a centralized organization, opportunities exist to capture efficiencies through economies of scale in delivery of programs and eliminating duplicative functions. Oversight will be required of this entity.

If each utility administers its own SBC proceeds, it is easier to implement programs tailored to the unique needs of its customers. This could result in inefficiencies due to replication of functions in both the utility and the regulator. For example, each utility would have to create, and the regulator would have to approve, individual detailed plans.

Another important design question with this policy is what mechanism should be used for the dispersal of the funds. There are two primary alternatives: (1) specific programs can be designed and administered by the responsible party. This is the most resource intensive since it will require larger staffs to design and implement the programs; and (2) the funds administrator can issue requests for proposals for third-parties to deliver these programs. While this approach is intuitively appealing since it appears to be market-oriented and hence more efficient, the administrative costs of such programs can be significant as well as the costs of measuring and verifying the savings.

The EMGC has not been assigned a role with respect to proposed system benefits charges, but it could choose to address some of these issues.

3.0.1 Experience in Other Jurisdictions

United States

As of March 2001, 22 states and Washington DC have developed public benefit programs either through legislation and/or regulatory orders. The allocation of SBC funding varies state by state between R&D, energy efficiency, low-income support and renewable energy. Table 1 provides a

snapshot on number of jurisdictions supporting the above listed initiatives.

Table 1: Number of Jurisdictions Supporting SBC

Total Jurisdictions with SBC Funding	*R&D*	*Energy Efficiency*	*Low Income*	*Renewable Energy*
23	4	20	22	16

Vermont

In March 2000, Vermont created "Efficiency Vermont", an energy efficiency utility that was dedicated to administering and implementing demand-side management (DSM) programs across the state. Historically, each of the state's 22 electric LDCs were responsible for DSM programs within their respective franchise areas. However, studies undertaken by the state government's Department of Public Service (DPS) indicated that overall effectiveness of DSM programs were hampered by having customized DSM programs across twenty-two service territories and increased efficiencies and effectiveness can be realized by adopting a centralized approach in the delivery of a comprehensive set of DSM programs across the state.

The operation of Efficiency Vermont was awarded through public tender to Vermont Energy Investment Corporation (VEIC), an independent non-profit organization. The RFP and ensuing contract provided clear terms and conditions about the scope of work, programs to be administered, level of funding, estimated budget and the incentive mechanism. DPS had already identified and designed the primary programs to be implemented and their funding level; Efficiency Vermont was given responsibility for the efficient implementation of specified core programs.

Efficiency Vermont is funded through an "energy efficiency charge", a per kWh charge that is consistent across the customer classes but varies among the 22 utilities. It is calculated as a straight percentage of customer's bill, similar to the calculation of sales tax. In 2001, the percentage ranged from 0.5 percent to 3.4 percent with an average rate of 2.2 percent.

As Efficiency Vermont has only been in existence for one year it is premature to assess its long-term effectiveness. However, results from their first annual report (Year 2000) indicate that they have been successful. In 2000, they exceeded their energy savings target by 55 percent and were able to accomplish this below budget.

United Kingdom

In the UK, the Non-Fossil Fuel Obligation (NFFO) similar to a SBC in that it

levies a small amount of cost on consumers and uses it to fund other programs. In the UK, it has supported renewables through periodic competitive tenders of power purchase agreements at premium prices where the winning bid is based solely on price. This has been the central policy tool for increasing the commercial deployment of renewable generating technologies. The payments to NFFO generators are funded by electricity consumers through the fossil fuel levy. It is estimated that the potential above-market costs of NFFO and its Scottish and Northern Ireland equivalents is in the range of £100 to £150 million per year for the next fifteen years.

To date, five NFFO orders have been made in England and Wales, two equivalent orders in Northern Ireland, and three in Scotland. Together the orders total 3.5 GW of renewable capacity and should contribute to around five percent of UK electricity supply by 2003. The goal is that 10 percent of the UK energy supply will be derived from renewable energy sources by 2010.

As of December 31, 2000, 911 MW of renewable energy capacity from the NFFO (in England and Wales) and its equivalents in Scotland and Northern Ireland had been commissioned and generating electricity.[14]

From the beginning, the average bid price has decreased with every auction. The cost of generating electricity from renewables under the NFFO for England and Wales has almost halved on average since 1990. The average price for the fifth (and most recent) NFFO in England and Wales was 2.71 p/kWh. This is 22 percent lower than the 3.46 p/kWh average price for NFFO-4 and 37 percent lower than the 4.35 p/kWh average price for NFFO-3.

The apparent success of NFFO is primarily attributed to three factors:

- NFFO has been structured as a sequence of auctions with enough elapsed time between them to realize improvements in technologies, bidding mechanisms and incorporate valuable lessons from previous auctions.

- Bidding occurs within technology bands resulting in competition amongst projects of similar technologies. This supports the development and innovation of new technologies and reduces the bias towards proven renewable technologies.

- Long contract terms of 15 years (for NFFO 3-5) provide additional certainty and stability which lowers the developers' cost of financing. Additionally developers have five years from the award date before commissioning the projects.

[14] Department of Trade and Industry, *New and Renewable Energy: Prospects for the 21st Century*, pp. 2, 12-3, and 48-9, at http://www.dti.gov.uk/renew/condoc/.

While the increased competitive nature of the NFFO auctions suggest that this policy has been effective, only 28 percent of the 3,271 MW of total capacity awarded has been commissioned. The actual commission rate is difficult to predict since developers may choose not to proceed with the contract since there are no penalties for not proceeding, or they may be deferring in the hopes that returns to green power will increase.

It is expected that the NFFO will be replaced by a Renewables Obligation (Obligation) in early 2002. Under the Obligation, electricity suppliers have to derive 3 percent of their sales from renewable sources, escalating annually with a target of 10.4 percent of sales by March 2011.

The UK is seeking to transition to the RO framework since it provides greater assurances that renewable facilities will be commissioned and supplying renewable power to the market. The RO framework also accelerates the promotion of renewables to provide a substitute for Britain's aging nuclear fleet while still maintaining its commitments made under Kyoto Pact. It is expected that RO in conjunction with an extensive R&D program will do a better job in stimulating the local renewable technology industry. Since the NFFO focused primarily on price, renewable bidders focused on reducing costs to increase margins. This resulted in much of the technology implemented (primarily wind) being imported from other countries, particularly Denmark and Germany.

3.1 Energy Efficiency of Government Facilities

Lead by example with a government house-in-order program that has targets for energy use in existing government-funded facilities. (2.7.4)

Begin to phase in energy efficiency standards for commercial heating, ventilating, and air conditioning equipment in provincially funded buildings. (2.7.4)

Develop and maintain an inventory of energy use for all provincially owned or funded facilities and all fuel used in the provincial vehicle fleet. (2.7.4)

Require that all new government-funded buildings exceed the targets of the model National Energy Code for Buildings by 25%, so that facilities may qualify for the Commercial Building Incentive Program (CBIP). (2.7.4)

Governments are major energy users themselves. They own and operate a significant number of buildings, and are responsible for funding many other buildings in the institutional sector (hospitals, schools, universities). By ensuring that their own buildings and other energy end uses are efficient,

governments can save money, demonstrate the effectiveness of energy efficiency investments, and reduce environmental impacts.

Many governments have adopted programs to ensure that economic energy efficiency investments are made in their own buildings. They can also commit to funding economic energy efficiency investments in institutional buildings under their jurisdictions, even though such funding might require altering capital funding guidelines. This can accomplish energy savings that are valuable in their own right, as well as encouraging others to do the same.

3.2 Promoting Use of Energy Service Companies

Where energy efficiency investments are economic, private companies often arise to profit from energy efficiency. A service firm can spread the costs of acquiring information and technical expertise to implement energy efficiency programs across its whole customer list. Costs that would be prohibitive for one energy user to bear alone become readily manageable when they are seen as an investment that gives the company a competitive edge.

3.3 Public Information Campaigns

Encourage energy efficiency in existing housing by supporting residential energy audits, expanded web-based energy information, publications, and advice to consumers. (2.7.4)

Work with the federal government and other partners to provide energy efficiency audits, information, and incentives to industry and small- and medium-sized businesses. (2.7.4)

Increase participation in the Voluntary Challenge and Registry through dissemination of information and assisting industry with requirements for participation. (2.7.4)

Many of the barriers to energy efficiency relate to information costs. For one user, the costs of acquiring information on the available technologies, their proper application, and their potential savings pose a prohibitive barrier. Information costs, added to the cost of the energy efficient technology, can make energy efficiency measures uneconomic. To alleviate this problem, governments can undertake information programs. The government can gather the required information and make it available for low or no cost. Giving the information to an additional energy user does not make it less valuable to the original user. Governments can therefore help everyone by making such information freely available.

Information and infrastructure development programs can therefore be expected to be important for improving energy efficiency.

Information programs are designed to overcome the information barrier by lowering the cost associated with identifying and gaining an understanding of the benefits of energy efficient products or services. Additionally, these programs can work to manage customers' expectations about the quality of the product or service. This information can be communicated in by means of different vehicles including general awareness campaigns, targeted awareness campaigns, mandated labeling and disclosure, performance standards, certification and licensing.

Technology demonstration funds support pilot testing as well as proven technologies that have yet to gain public acceptance and achieve significant market share. The fund would support their commercialization by providing assistance with their installation in the private market with the expectation that upon installation, these technologies would yield technical and economic benefits. This fund could be structured as a revolving fund where the funding is returned once the technology is successful.

The Residential and Commercial Building Tables Studies of the National Climate Change Process identified technology demonstration programs as a recommended measure. As described in the studies, the program would include demonstrations of new technology which is market ready but not yet adopted and support activities for the technology adoption. The support would include workshops and dissemination of information on the technology and its performance.

APPENDIX: SUMMARY OF NET METERING PROGRAMS

<!-- START TEMPLATE -->Source: http://www.eren.doe.gov/greenpower/netmetering/nmtable.shtml. ThisTable was last updated on 08/09/02

State	Allowable Technology and Size	Allowable Customer	Statewide Limit	Treatment of Net Excess Generation (NEG)	Authority	Enacted	Scope of Program	Citation/Reference
Arizona	Renewables and cogeneration ≤100 kW	All customer classes	None	NEG purchased at avoided cost	Arizona Corporation Commission	1981	All IOUs and RECs	PUC Order Decision 52345, Docket 81-045
Arkansas	Renewables, fuel cells and microturbines ≤25 kW residential ≤100 kW commercial	All customer classes	None	Monthly NEG granted to utilities	Legislature	2001	All utilities	HB 2325, effective Oct. 2001 PSC Order No. 3, July 3, 2002
California	Solar and wind ≤1000 kW	All customer classes	None	Annual NEG granted to utilities	Legislature	2001/ 1995	All utilities	Public Utilities Codes Sec. 2827 (amended 04/01; effective 9/98)
Colorado	Wind and PV 3 kW, 10 kW	Varies	NA	Varies	Utility tariffs	1997	Four Colorado utilities	PSCO Advice Letter 1265; PUC Decision C96-901 [1]
Connecticut	Renewables and fuel cells ≤100 kW	Residential	None	Not specified	Legislature	1990, updated 1998	All IOUs, No REC in state.	CGS 16-243H; Public Act 98-28
Delaware	Renewables ≤25 kW	All customer classes	None	Not specified	Legislature	1999	All utilities	Senate Amendment No. 1 to HB 10
Georgia	Solar, wind, fuel cells ≤10 kW residential ≤100 kW commercial	Residential and commercial	0.2% of annual peak demand	Monthly NEG or total generation purchased at avoided cost or higher rate if green priced	Legislature	2001	All utilities	SB93
Hawaii	Solar, wind, biomass, hydro ≤10 kW	Residential and small commercial	0.5% of annual peak demand	Monthly NEG granted to utilities	Legislature	2001	All utilities	HB 173
Idaho	All technologies ≤100 kW	Residential and small commercial (Idaho Power only)	None	Monthly NEG purchased at avoided cost	Public Utility Commission	1980	IOUs only, RECs are not rate-regulated	Idaho PUC Order #16025 and #26750 (19 Tariff sheets 86-1 thru 86-7
Illinois	Solar and wind ≤40 kW	All customer classes; ComEd only	0.1% of annual peak demand	NEG purchased at avoided cost monthly plus annual payment to bring payment to retail	ComEd tariff	2000	Commonwealth Edison	Special billing experiment [1]

				rate				
Indiana	Renewables and cogeneration ≤1,000 kWh/month	All customer classes	None	Monthly NEG granted to utilities	Public Utility Commission	1985	IOUs only, RECs are not rate-regulated	Indiana Administrative Code 4-4.1-7
Iowa	Renewables and cogeneration (No limit per system)	All customer classes	105 MW	Monthly NEG purchased at avoided cost	Iowa Utility Board	1993	IOUs only, RECs are not rate-regulated[2]	Iowa Administrative Code [199] Chapter 15.11(5)
Kentucky	Solar, hydro, wind ≤10 kW residential ≤25 kW non-residential	All customer classes	First 25 customers for each utility	Annual NEG granted to utilities	Public Utility Commission	2002	Louisville Gas & Electric, Kentucky Utilities	Order March 14, 2002 Case 2001 - D0303, D0304
Maine	Renewables and fuel cells ≤100 kW	All customer classes	None	Annual NEG granted to utilities	Public Utility Commission	1998	All utilities	Order # 98-621 RC of ME Chapter 36
Maryland	Solar only ≤80 kW	Residential and schools only	0.2% of 1998 peak	Monthly NEG granted to utilities	Legislature	1997	All utilities	Article 78, Section 54M
Massachusetts	Qualifying facilities ≤60 kW	All customer classes	None	Monthly NEG purchased at avoided cost	Legislature	1997	All utilities	Mass. Gen. L. ch. 164, §1G(g); Dept. of Tel. and Energy 97-111
Minnesota	Qualifying facilities ≤40 kW	All customer classes	None	NEG purchased at utility average retail energy rate	Legislature	1983	All utilities	Minn. Stat. §216B.164
Montana	Solar, wind and hydro ≤50 kW	All customer classes	None	Annual NEG granted to utilities at the end of each calendar year.	Legislature	1999	IOUs only	SB 409
Nevada	Solar and Wind ≤10 kW	All customer classes	First 100 customers for each utility	Monthly or annual NEG granted to utilities	Legislature	1997	All utilities	Nevada Revised Statute Ch. 704
New Hampshire	Solar, wind and hydro ≤25 kW	All customers classes	0.05% of utility's annual peak	NEG credited to next month	Legislature	1998	All utilities	RSA 362-A:2 (HB 485)
New Jersey	PV and wind ≤100 kW	Residential and small commercial	0.1% of peak or $2M annual financial impact	Annualized NEG purchased at avoided cost	Legislature	1999	All utilities	AB 16. Electric Discount and Energy Competition Act

New Mexico	Renewables and cogeneration ≤10 kW	All customer classes	None	NEG credited to next month, or monthly NEG purchased at avoided cost (utility choice)	Public Utility Commission	1999	All utilities	NMPUC Rule 571, 17 NMAC 10.571
New York	Solar only ≤10 kW	Residential only	0.1% 1996 peak demand	Annualized NEG purchased at avoided cost	Legislature	1997	All utilities	Laws of New York, 1997, Chapter 399
North Dakota	Renewables and cogeneration ≤100 kW	All customer classes	None	Monthly NEG purchased at avoided cost	Public Utility Commission	1991	IOUs only, RECs are not rate-regulated	North Dakota Admin. Code §69-09-07-09
Ohio	Renewables, microturbines, and fuel cells (no limit per system)	All customer classes	1.0% of aggregate customer demand	NEG credited to next month	Legislature	1999	All utilities	S.B. 3 (effective 01/01/01)
Oklahoma	Renewables and cogeneration ≤100 kW and ≤25,000 kWh/year	All customer classes	None	Monthly NEG granted to utility	Oklahoma Corporation Commission	1988	All utilities	OCC Order 326195
Oregon	Solar, wind, fuel cells and hydro ≤25 kW	All customer classes	0.5% of peak demand	Annual NEG granted to low-income programs, credited to customer, or other use determined by Commission	Legislature	1999	All utilities	H.B. 3219 (effective 9/1/99)
Pennsylvania	Renewables and fuel cells ≤10 kW	Residential	None	Monthly NEG granted to utility	Legislature	1998	All utilities	52 PA Code 57.34
Rhode Island	Renewables and fuel cells ≤25 kW	All customer classes	1 MW for Narragansett Electric Company	Annual NEG granted to utilities	Public Utility Commission	1998	Narragansett Electric Company	PUC Order Docket No. 2710
Texas	Renewables only ≤50 kW	All customer classes	None	Monthly NEG purchased at avoided cost	Public Utility Commission	1986	All IOUs and RECs	PUC of Texas, Substantive Rules, §23.66(f)(4)
Utah	Solar, wind, hydro and fuel cells ≤25 kW	All customer classes	0.1% of 2001 peak demand	NEG credited within billing cycle at least at avoided cost, any unused credit granted to the utility at the end of the calendar year	Legislature	2002	All IOUs and RECs	HB7, March 2002
Vermont	PV, wind, fuel cells ≤15 kW Farm biogas ≤150 kW	Residential, commercial and agricultural	1% of 1996 peak	Annual NEG granted to utilities	Legislature	1998	All utilities	Sec. 2. 30 V.S.A. §219a; amended 2002, S.138
Virginia	Solar, wind and hydro Residential ≤10 kW Non-residential ≤25 kW	All customer classes	0.1% of peak of previous year	Annual NEG granted to utilities (power purchase agreement is allowed)	Legislature	1999	All utilities	Virginia Assembly S1269 Approved by both Assembly and Senate 3/15/99

Washington	Solar, wind, fuel cells and hydro ≤25 kW	All customer classes	0.1% of 1996 peak demand	Annual NEG granted to utility	Legislature	1998	All utilities	Title 80 RCW House Bill B2773
Wisconsin	All technologies ≤20 kW	All retail customers	None	Monthly NEG purchased at retail rate for renewables, avoided cost for non-renewables	Public Service Commission	1993	IOUs only, RECs are not rate-regulated	PSCW Order 6690-UR-107
Wyoming	Solar, wind and hydro ≤ 25 kW	All customer classes	None	Annual NEG purchased at avoided cost	Legislature	2001	All IOUs and RECs	HB 195, Feb. 2001

Notes:

IOU — Investor-owned utility
GandT — Generation and transmission cooperatives
REC — Rural electric cooperative

[1] For information, see the Database of Statet Incentive for Renewable Energy (http://www.dcs.ncsu.edu/solar/dsire/dsire.cfm).
[2] Except for the Linn County Electric Cooperative, which is rate-regulated by Iowa PUC.

The original format for this table is taken from: Thomas J. Starrs (September 1996). *Net Metering: New Opportunities for Home Power.* Renewable Energy Policy Project, Issue Brief, No. 2. College Park, MD: University of Maryland